Amendment H

LASER PULSE IMAGE SWITCHES

Background - Field of Invention:

[0001] This invention relates to switches and to the use of information symbols or scenes on MicroElectroMechanical System (MEMS) mirrors and/or on the exit mirrors of laser arrays and the like. Definition: " image " defined as the pattern or form or relative position of photons in an optical pulse, beam or front as it moves through space, optical fibers and the like. These " images " become visible when the photons encounter a surface or are displayed, this is, also, commonly called an image.

Background - Prior Art:

[0002] The use of binary switches and the resulting binary code have required that relatively long code strings be used to represent or transmit simple symbols. The output or product of " LASER PULSE IMAGE SWITCHES " could be a stream (string) of very short (e.g. femtosecond) laser pulses,

small enough (diameter or cross section) to be carried on optical fiber systems. Each laser pulse being a discrete, separate, image of information symbols or scenes and the like.

[0003] The following four patents: Sakuma et al., U.S. Patent #6,292,305 B1; Betensky et al., U.S. Patent#5,745,301; Tanaka et al., U.S. Patent#5,754,712; and Braat, U.S. Patent#6,317,276 B1; disclose operations on images, respectively: display; demagnification; searching, storing and displaying; writing and/or reading. They do not create the image signal or image input. The creation of the image signal or image input as images would be the purview of " LASER PULSE IMAGE SWITCHES ".

[0004] Sakuma et al., U.S. Patent # 6,292,305 B1 disclose a virtual screen display apparatus and ... a relatively small image display for displaying characters or image information... [apparently of a size to be human observable] or

"Means to create minuscule alphanumeric images by reflection and by/in the light pulse, for presentation on a real or virtual display screen" (from 2002, April 2 O.A.). As shown in Fig. 15,(Sheet 15 of 20, lower left) and described in Column 1, Lines 5-10 this device displays images which are created by an output device. The creation of these images would be the purview of " LASER PULSE IMAGE SWITCHES ", an output device.

[0005] Lens systems to produce small images of varying magnification for detection by an electronic imaging system or "Lens systems for producing small images" (from 2002, April 2 O.A.) are disclosed by Betensky et al. (U.S. Patent 5,745,301).

[0006] An image processing apparatus for searching, storing, and displaying characters, sentence fragments, sentences or documents or "A device for searching any character string of a sentence input as an image" (from 2002, April 2 O.A.) is disclosed by Tanaka et al. (U.S. Patent 5,754,712).

[0007] An optical lens system and scanning device for reading and/or writing information in an information plane or "An optical scanning device for reading and writing information in an information plane" (from 2002, April 2 O.A.) is disclosed by Braat (U.S. Patent 6,317,276 B1).

[0008] The absolute/unique distinction between, the four patents referenced above (Sakuma et al., Betensky et al, Tanaka et al., and Braat) and "LASER PULSE IMAGE SWITCHES", can be demonstrated by reference to Sakuma et al., U.S. Patent 6,292,305 B1, Sheet 15 of 20, FIG. 15. In the lower left corner of FIG. 15 is the term "IMAGE SIGNAL", to the left of that would be the purview of "LASER PULSE IMAGE SWITCHES".

[0009] The same distinction would apply to the other three patents: Tanaka et al., U.S. Patent 5,754,712, Sheet 1 of 23, FIG. 1, upper left, "IMAGE INPUT UNIT", above that would be the purview of "LASER PULSE IMAGE SWITCHES".

Betensky et al., U.S. Patent 5,745,301, ABSTRACT, First sentence, "Variable power lens systems for use with electronic imaging systems, e.g. systems employing CCDs, are provided." , would be synergistic with the purview of "LASER PULSE IMAGE SWITCHES".

Braat, U.S. Patent 6,317,276 B1, Abstract, last sentence, "This lens system is very suitable for a scanning device and an apparatus for reading/writing high-density optical discs." , would be synergistic with the purview of "LASER PULSE IMAGE SWITCHES".

[0010] "LASER PULSE IMAGE SWITCHES" would likely be synergistic with OCR equipment.

[0011] The prior four patents refer to operations performed on images which could be created, or produced by " LASER PULSE IMAGE SWITCHES ".

[0012] "An electrically actuated microelectromechanical television scanning device for television image scanning or related functions. The scanning device can be produced in forms having characteristic dimensions in the submillimeter range. ..." is disclosed by Johnson (U.S. Patent 5,673,139). This patent does not show or infer any attempt or concept to create, form or etch, information symbols or scenes onto the switch elements, i.e. optical surfaces (mirrors, laser exit mirrors, or the like).

Hence, Johnson, U.S. Patent 5,673,139, does not anticipate "LASER PULSE IMAGE SWITCHES".

[0013] A "... light-actuated photonic switch is disclosed..." by Aksyuk et al., U.S. Patent 6,075,239. This patent does not describe any attempt or concept of creating, forming or etching information symbols or scenes onto the switch elements, i. e. optical surfaces (reflectors, mirrors, or the like). Hence, Aksyuk et al., U.S. Patent 6,075,239, does not anticipate " LASER PULSE IMAGE SWITCHES ".

[0014] " A cross-connect switch for fiber-optic communication networks employing a wavelength dispersive element, such as a grating, and a stack of regular (non-wavelength selective) cross bar switches using two-dimensional arrays of micromachined, electrically actuated, individually-tiltable, controlled deflection micro-mirrors for providing multiport switching capability for a plurality of wavelengths. ..." is disclosed by Solgaard et al., U.S. Patent 6,389,190 B2. The word " image " is used in several places in Column 2, it is clear , from the context, that the meaning is to position or focus the optical beams onto mirrors or fiber ends. This patent does not describe any attempt or concept of creating, forming, or etching information symbols or scenes on the switch elements, i.e. optical surfaces (micro-mirrors, gratings, or the like). Hence, Solgaard et al., U.S. Patent 6,389,190 B2, does not anticipate " LASER PULSE IMAGE SWITCHES ".

[0015] The above patents: Johnson, U.S. Patent 5,673,139 , Aksyuk et al., U.S. Patent 6,075,239, and Solgaard et al., U.S. Patent 6,389,190 B2, are likely to be synergistic with " LASER PULSE IMAGE SWITCHES ".

[0016] Sullivan et al, U.S. Patent # 6,466,185 B2, "Multi-Planer Volumetric Display System and Method of Operation Using Psychological Vision Cues" discloses "... An image projector selectively projects images on respective optical elements to generate a volumetric three-dimensional image viewable in the multi-surface optical device. Psychological vision cues are added..." (Abstract). Note: The above is clearly a human scale display device. Sullivan continues "... In a further embodiment, different technologies may be used to implement the SLM (spatial light modulations) provided that high speed operation is attained. For example high speed liquid crystal devices, modulations based on

micro-electromechanical (MEMS) devices, or other light modulating method may be used to provide such high frame rate imaging. For example, the Digital Light Processing (DLP) technology of TEXAS INSTRUMENTS, located in Dallas Tex.; the Grating Light Valve (GLV) technology of SILICON LIGHT MACHINES, located in Sunnyvale, Calif.; and the analog ferroelectric LCD devices of BOULDER NONLINEAR SYSTEMS, located in Boulder, Colo., may be used to modulate the images for output by the image projector 20. Also, the SLM may be a ferroelectric liquid crystal (FLC) device, and polarization biasing of the FLC SLM may be implemented.

To obtain very high resolution images in the MVD (Multi-Planer Volumetric Display) system 10, the images 44-50 must be appropriately and rapidly re-focused onto each corresponding optical element of the MOE (multiple optical element) device 32, in order to display each corresponding image on the optical element at the at the appropriate depth. ..."(Col. 12, Lines 49-68+).

[0017] This patent does not describe any attempt or concept of etching information symbols or scenes onto MEMS mirrors, laser arrays, or

gratings. Sullivan et al., U.S. Patent # 6,466,185 B2, does not anticipate " LASER PULSE IMAGE SWITCHES ".

[0018] Also, Sullivan, Fig. 1, lower center, shows "Graphic Input Source", to the right of that would be the purview of "LASER PULSE IMAGE SWITCHES ", an output device.

[0019] "Optical Switching Device, Picture Display and Projection Apparatus", U.S. Patent # 6,198,566 B1 to Takeda et al., discloses ... ..." a light guiding member equipped with a total reflection surface capable of transmitting an incoming light ray for image display by means of total reflection, and an optical switching member having a micro prism that extracts evanescent light leaking out of the total reflection surface and reflects it to a display area of the total reflection surface. "(Abstract).

Takeda et al., discloses an "ON/OFF" optical switch, Fig. 2 & 3 and Col. 2, line 29 et al.,

[0020] This patent does not describe any attempt or concept of etching, information symbols or scenes into the switch elements, i.e. optical surfaces (micro-mirrors, gratings, micro-prisms, or the like). Hence, Takeda et al., U.S. Patent 6,198,566 B1, does not anticipate

" LASER PULSE IMAGE SWITCHES ".

[0021] Barrett et al., U.S. Patent # 6,005,990, "System For Optically Scanning Images Using Optical Shutter", discloses .... "...a light source 102 , a optical shutter 104, an optical sensor 106, and a scanner controller 108. The light source102 and optical shutter 104 cooperatively "present" an image to the optical sensor 106. ... and creates an electronic representation of the scanned image." (Col. 2, lines 52 – 65).

[0022] Barrett continues, "... the scanning cursor is the smallest possible unit of scanning resolution with a monolithic or segmented monolithic optical sensor. And, the entire image area is scanned by sequentially moving the scanning cursor in a pattern to systematically traverse the entire image area. For each sequential position of the scanning cursor, the optical sensor 106 measures the shuttered light corresponding to that region of the image area. For each of the many tiny regions of the image areas, then, the optical sensor 106 thus creates an electrical output signal representative of the light signal detected at that region. ..." (Col. 12, lines 2 –15).

[0023] The Applicant respectfully asserts that the Barrett reference (Col. 1, lines 30-31, Figs. 1,8,10 11,12) discloses "... optical image scanning by presenting the image to an optical sensor via an optical shutter. ..." and that optical shutter scanning by a scanning device with transparent qualities does not anticipate; discrete, separate, laser light pulse images with a predetermined duration (femtosecond) and a predetermined size and the like.

[0024] This patent does not describe any attempt or concept of etching information symbols or scenes on the switch elements, i.e. optical surfaces (micro-mirrors, gratings, laser exit mirrors, or the like). Hence, Barrett et al., U.S. Patent 6,005,990, does not anticipate " LASER PULSE IMAGE SWITCHES ".

[0025] "Arrangement for Shifting Optical Images Between Individual Channels" to Buttner, U.S. Patent # 5,936,759, discloses "... A plurality of imaging optical systems adapted to image conjugately upon each other, in an associated shiftable optical channel, an associated plane and an intermediate image

plane, comprise a micro-mechanical mirror system (mirror array) arranged in ... such a manner, that they optically connect optionally one of the shiftable channels to the common channel."(Abstract).

[0026] This patent does not describe any attempt or concept of, etching information symbols or scenes into the switch elements, i.e. optical surfaces (micro-mirrors, gratings, laser exit mirrors, or the like). Buttner, U.S. Patent # 5,936,759, does not anticipate " LASER PULSE IMAGE SWITCHES ".

Buttner and Solgaard do establish a generic third means for shifting/switching of optical images which could be used for shifting/switching of laser pulse images.

[0027] The above four patents: Sullivan et al., U.S. Patent #6,466,185 B2; Takeda et al., U.S. Patent#6,198,566, B1; Barrett et al., U.S. Patent#6,005,990; and Buttner, U.S. Patent#5,936,759; disclose operations on images, respectively: volumetric display, switching-display-projection, optically scanning, and shifting optical images.

[0028] They do not infer, imply, or describe the etching of information symbols or scenes into the optical surfaces of MEMS mirrors, laser exit mirrors and the like.

[0029] The above four patents: Sullivan et al., U.S. Patent #6,466,185 B2;

Takeda et al., U.S. Patent#6,198,566, B1;

Barrett et al., U.S. Patent#6,005,990; and

Buttner, U.S. Patent#5,936,759; are likely to be

synergistic with " LASER PULSE IMAGE SWITCHES ".

[0030] Stern et al., U.S. Patent 5,877,899, 03-02-1999, "Imaging System and Method for Imaging Indicia on Wafer", Relevant: Abstract; "... imaging system for viewing indicia of an object to be observed in which the indicia comprises ... either hard and/or soft marks. ...", and Col. 4, lines 12-13, "... the invention is to provide an inspection system ...", and, (Applicant Note: Stern et al., is using /defining "imaging " to be viewing/observing/inspecting of preexisting indicia, such as in), Col. 5, lines 9-26+, "... imaging system for imaging a desired surface of an object to be observed and containing indicia; ...", and Col. 6, lines 9-13, "... Fig. 3 is ... the inspection system according to the present invention. Fig. 3A is ...the simplest form of the inspection system ...", and in Col. 7, lines 21-24+, "... The present invention makes use of ... an inspection device ...", and in Col. 8, lines 15-18+, "... the inspection system, according to the present invention, .." and in Col. 8, lines 26 -40+, "... light emitting diodes (LED) 66, ...lenses 36

and 38..., mirror 40 ..., to reflect the focused light at the object 32 to be observed." And Col. 7 lines 63-65, " ... the reflected ... light will be captured by ... the camera 52 and used to image the indicia 30 on the object to be observed 32."

[0031] Further; Stern et al., U.S.P. 5,877,899, "Imaging System and Method for Imaging Indicia on Wafer", Col. 6, lines 12-14, read "Fig. 3A ... simplest form of the inspection system... .", discloses several (more than 3) parts.

In general overview the present invention is far simpler, i.e. fewer parts, than the Stern et al., '899, Imaging System..., reference.

[0032] **Simplicity of this present invention**, to create/form laser pulse images. The present invention, in a simple form (symbols formed on the exit mirrors of lasers) has one part (the laser), a laser pulse from a laser forms a laser pulse image of the symbol(s) on that specific exit mirror, Figs. 4-6.

The present invention also includes a form with two parts, a laser, and a MEMS switch with symbols formed on the optical surfaces, mirrors, Figs. 1-3. A reflected laser pulse forms a reflected laser pulse image of the symbol(s) on that particular optical surface or mirror.

[0033] **Stern complexity,** 3 or more parts , see Fig. 3A.

Stern et al., - 899, Col. 6, line 12, reads "FIG. 3A ... the simplest form of the inspection system... ." (Note the term "system".) The text description of FIG. 3A,

Col. 11, lines 6-59, and Fig. 3A, describes 3 or more parts. Note: Fig. 11, added more parts, (a light valve and a diffuser), making the Stern "system" more complex. The Stern "system" reference does not, repeat not and could not anticipate this present invention.

[0034] Present invention, lasers: Stern apparently not a laser system.

Stern et al Col. 6, lines 48-50, reads "Fig. 11 ... a fifth embodiment...". And Col. 14, lines 12-14, reads "... a programmable liquid crystal light valve used in conjunction with a high density diffused back light. ..." and lines 17-19, read "Fig. 11 shows ... a light source 84 provides light to a rear surface 86 of a diffuser 88. The diffused light emanates...".

Note: This "fifth embodiment" specifies "diffused" light. The prior four embodiments appear to specify "diffused" light. Lasers are not specified .

Stern , Col. 8, lines 26-27, reads "... light emitting diodes (LED) 66...".

Col. 13, lines 23 –28, read "... by placing a diffuser 70 in front of the LED array, i.e. between the LEDs 66 ... make the light field created by each LED 66 appear substantially identical to that of all other LEDs contained in the array (see Fig 8)."

Further, Col. 8, lines 26-27, reads "... light emitting diodes (LED) 66...".

Note: the coherent light property of lasers would likely be destroyed in the diffusers, 70, 88, of the Stern "system". The description of the first five

embodiments of the Stern system does not specify lasers, and Stern does not contain the terms "laser pulses", "reflected laser pulses", "laser pulse images", "reflected laser pulse images" or "laser pulse image switches". The Stern '899 reference does not, repeat not, and could not anticipate the present invention.

[0035] Present invention, active; Stern '899 is a passive "imaging system"

Stern specifies the "object to be observed 32" to be a "semiconductor wafer" as in Fig. 1. A static semiconductor wafer, as specified by Stern, has no, repeat no switching capabilities comparable to the well known switching capabilities of MEMS mirror switches, Stern, as described, is not a "laser pulse image switch". Stern does not contain the terms "MEMS mirrors" or "MEMS mirror switches" and Stern does not and could not anticipate the present invention.

Stern et al., '899, may be synergistic with the present invention. Stern does not and could not anticipate the "laser pulse image switches" of the present invention. This present invention appears to be outside the envelope or box for Stern et al..

[0036] Stern et al. '899 does establish a generic second means of viewing/observing/inspecting/ indicia on a specular surface which may be adapted for use with the laser pulse images and the laser pulse image switches of the present invention.

Stern et al., does not, repeat not, contain or infer the phrases or concepts

of "laser pulses, laser pulse images, or laser pulse image switches", and does not, repeat not, anticipate the present invention.

The above, are the Applicant's ongoing efforts to codify this present invention, laser pulse image switches, does not contain "new matter".

[0037] NOTICE; Mental adaptability required here:

Stern et al. '899, (above), uses/ defines "imaging" to be viewing/observing/inspecting of preexisting indicia, as with a camera.

Chovan et al. '951, (below) uses/defines "imaging" to be etching/forming images onto a metallic surface, as with a laser beam.

[0038] Chovan et al., U.S. Patent 3,920,951, 11-18-1975, "Laser Etching Apparatus for Forming Photographic Images on Metallic Surfaces",

Relevant: Abstract, "... laser etching apparatus for forming a photographic image on a metallic or non-metallic surface... an assemblage of laser etched craters. In dark regions of the picture, the craters occur in greater densities while in light regions of the picture, the craters occur in lesser densities. ...", and Col. 1, lines 25-41, "... use of a laser to machine away an image on a thin film metallic film has been suggested. A transparency of

appropriate size is illuminated with a high energy laser pulse and the image is focused down to a tiny micro image on the thin film. ... a demagnified version of the image on the transparency will be formed on the metal film. ...", and Col. 1, lines 64-65, " ... apparatus for etching photographic images upon a metallic surface.", and Col. 2, lines 25-28, "... The imaging means concentrates the laser energy to form a pit on the blank for each laser pulse, the pits locally altering the reflectivity of the blank, ..." (see below) and Col. 4, lines 58-62, "... photodetector produces an electrical signal indicating the brightness of the picture element imaged on it and this electrical signal is then applied to the switching rate controller 20 to control the firing rate of the laser.".

Note: Col. 2, lines 25-28, "... form a pit on the blank for each laser pulse...". The Chovan use of laser pulses is as a metal surface deforming means, ".... To form a pit on the blank for each laser pulse, ..." Col. 2, lines 25-28 and "... using a laser for etching a photographic image onto a metal...", Col. 3, lines 14-15.

Note: Col. 2, lines 25-28, "... The imaging means ... to form a pit ... for each laser pulse ...". The Chovan language defines/uses "imaging" to refer to the formation/creation of an image/scene/picture on a metal surface.

Chovan et al., does not, repeat not, infer the concept or contain the phrase "laser pulse image switches" and does not anticipate this present invention.

[0039] Chovan et al. contributes to the broad generic first means of etching which could be used for forming symbols and or scenes onto the optical surfaces of MEMS mirrors or lasers and the like.

[0040] Stanisci, U.S. Patent 5,331,443, 07-19-1994, " Laser Engraved Verification Hologram and Associated Methods",

Relevant: Abstract, "... laser etching individualized indicia into the reflective layer of each hologram ...", and Col. 3, lines 1-2, "... Fig 1 further illustrates a laser 22 etching indicia 24 into the reflective aluminum layer 16. ...".

Stanisci does not, repeat not, infer the concept or contain the phrase "laser pulse image switches" and does not anticipate this present invention.

[0041] These two patents: Chovan et al., U.S. Patent 3,920,951, and Stanisci, U.S. Patent 5,331,443, establish a very broad generic first means for etching or forming which could be used for creating symbols or scenes into/onto the optical surfaces of MEMS mirrors and lasers.

[0042] Stern et al., U.S. Patent 5,877,899, establishes a broad generic second means for viewing/observing/inspecting symbols or scenes which could be adapted for use on/in the optical surfaces of the marked MEMS mirrors of the present invention.

None of the above appears to contain the concept of etching or forming (indicia) symbols or scenes into/on the optical surfaces of lasers, such that the emitted laser pulse is a laser pulse image.

[0043] The operation and function of MEMS mirrors well known in prior art and the transmission of laser pulses in optical fibers has been practiced since the mid 1970s, and may be considered common practice, and a broad generic fourth means which could be adapted/used for transmitting laser pulse images.

[0044] Another perspective: As the Applicant understands it, the state of the art of optical communication is concerned with the pulses of laser light as a binary, on/off, code of communications.

The present invention is concerned with laser pulse images, i.e. pattern and number of photons with-in/comprising a laser pulse, as a means of communications.

[0045] These three patents: Stern et al., U.S. Patent 5,877,899, and Stanisic, U.S. Patent 5,331443, and Chovan et al., U.S. Patent 3,920,951, would likely be synergistic (this may be an understatement) with this present invention.

[0046] The unique, enabling paradigm of " LASER PULSE IMAGE SWITCHES " is the first means for etching, creation, or formation of information symbols or scenes onto the optical surface(s) of MEMS mirrors, exit mirrors of laser arrays, and the like; and the second means for creation of optical images of these information symbols or scenes with very short pulses of laser light; and the third means for selective switching of these laser pulses to create a string of images, and the fourth means for transmitting laser pulse images.

The prior patents do not infer, suggest, or describe this paradigm.

Objects and Advantages:

[0047] Information, including scenes and/or alphanumeric symbols, on the mirrors of MEMS switches, and/or the exit mirrors of laser arrays and the like, allow the representation, switching and/or transmission of images with very short pulses of laser light.

[0048] One embodiment, an array of 256 image switch elements (MEMS mirrors, laser arrays and the like) with alphanumeric symbols on each switch element could function as an alphanumeric image string switch.

[0049] The use of a, sequence label, in the switch address system would allow switching to any/all of the 256 image switch elements in any sequence, with each address operation. By including a, sequence plus time index label, the potential alphanumeric image string can become extremely long for each address operation.

[0050] The advantage of laser pulse image switches would be the increased efficiency of directly switching, transmitting, manipulating, and storing information as images of alphanumeric symbols or scenes, without the archaic conversion into binary code and the subsequent decoding.

[0051]Drawings Description, Brief ;

Fig. 1, schematic of a MEMS based, laser pulse image switch.

Fig. 2, illustrates the laser pulses, P, reflected at the MEMS mirrors with symbols, s, to create/form the reflected laser pulse images of s, PI 1-3, and the CCD readout, s.

Fig. 3, illustrates the laser pulses, P, reflected at the MEMS mirrors with symbols, s, to create the reflected laser pulse images of s, PI 1-3, transmitted through an optical fiber, and the CCD readout, s.

Fig. 4, schematic of a laser based, laser pulse image switch.

Fig. 5, illustrates lasers with symbols, s, on the exit mirrors, and the laser pulse images of s, LPI 4-6, and the CCD readout, s.

Fig. 6, illustrates lasers with symbols, s, on the exit mirrors, and the laser pulse images of s, LPI 4-6, transmitted through an optical fiber, and the CCD readout, s.

[0052] Drawings Description, Detailed

Fig. 1, schematic of a MEMS based laser pulse image switch, shows the laser pulse source, (pulse laser), sending a laser pulse to the MEMS based laser pulse image switch, to create a laser pulse image, PI, and the laser pulse image readout and/or storage.

Fig. 2, illustrates the pulse laser, sending laser pulses, P, to the MEMS based, laser pulse image switch. The MEMS mirrors have symbols, s, formed thereon and the reflected laser pulses create, form, reflected laser pulse images, PI 1-PI 3, of the symbols, s. The reflected laser pulse images, PI, go to a CCD readout, of s.

Fig. 3, illustrates optical fiber(s) may transmit the laser pulse images of Fig. 2.

Note 1: These MEMS based laser pulse image switches may also be described as:

An optronic/photonic device comprising:

at least one symbol etched or formed on the mirrors of MEMS switches, and;

at least one laser pulse, whereby the laser pulse is reflected from said mirror and forms a reflected laser pulse image of said symbol .

Fig. 4, schematic of a laser based, laser pulse image switch, the laser pulses are the laser pulse images, LPI, and go to the laser pulse image readout, storage.

Fig. 5, pulse lasers with symbols, s, formed on the exit mirrors, such that the laser pulses are laser pulse images, LPI 4-LPI 6, which go to a CCD readout of s.

Fig. 6, illustrates optical fiber(s) may transmit the laser pulse images, LPI, to the CCD readout of s.

Note 2: This embodiment of laser pulse image switches may be described as:

An optronic/photonic device comprising:

at least one symbol formed on the exit mirror of at least one laser, and;

at least one laser pulse from said laser whereby said laser pulse is the laser pulse image of said symbol.

Note 3: This present invention, laser pulse image switches, may be generically described as: MEMS mirrors with symbols formed thereon, and;

laser exit mirrors with symbols formed thereon, whereby reflected laser pulses and laser pulses, respectively, form laser pulse images of the symbols.

Summary:

[0053] Information symbols or scenes formed on MEMS mirrors and/or the exit mirrors of laser arrays and the like, allow these devices to function as laser pulse information image switches, producing a string of laser light pulses, each an image of information symbols or scenes. These switches would be used in optronic/photonic devices and systems/networks.

Description:

[0054] Information symbols or scenes, (reflective or nonreflective, positive or negative), are etched or formed onto the mirrors of MEMS switches and/or the exit mirrors of laser arrays and the like (other optical switch devices). By selectively switching which MEMS mirror reflects a laser light pulse or which laser emits a laser light pulse, these devices function as laser pulse image switches.

Operation:

[0055] A light pulse, reflected or emitted from a laser pulse image switch element would form a image of the symbol(s)/scene(s) on that element. These pulses could be ultra-short (e.g. femtosecond) and each pulse, a discrete, separate, and different image. The light pulse image(s) could be directed into an optical fiber for transmission. Projection of the light pulse image(s) onto a CCD chip (or screen) would provide readout. Storage might be recording of the symbol image(s) directly onto a CD (or with light stopping methods of Rowland Institute).

Conclusion, Ramifications and Scope:

[0056] The limiting factor may be the number of photons necessary to form an image. Many paths toward that limit appear possible: for example, extremely small symbols, extremely short light pulses, multiple symbols on each switch element, lens systems, very high element number switches; i.e. current MEMS switches have 256 mirrors (possible symbols), frequency multiplexing; i.e. each frequency of the light pulse forming an image, and reflective symbols on a nonreflective background. Alternatively: symbols might be formed directly onto the exit mirrors of lasers such that the laser pulse, itself, is the image; or images created by passing the light pulse through a image medium. Eventually, a image may be worth a thousand bits.

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